

showing the possible new values has a grid that is generally perpendicular to the line. The shape of the active region of possible new data values need not be a parallelogram.

The line 370 that shows the change in y-value for a base x-value is useful even with the known arrangement of FIG. 2.

5 A variety of mathematical or empirical functions may be used for drawing curve 360 to pass through the point N and the end points of line 315.

The relationship of (i) the normal distance of a point on new line 360 to line 315 to (ii) the change from old value to new value need not be linear. Thus, for example, the scale of the grid in the active region can be logarithmic in the normal direction.

10 The base values can be default values with the new line showing a current transformation from the default. The base values can also be values the resulted from a previously-performed transformation. Or, the base values can be selected in some other way.

15 The techniques described here may be implemented in hardware, software, or a combination of the two. The techniques may be implemented in computer programs executing on programmable computers that each include a processor, a storage medium readable by the processor, including volatile and nonvolatile memory and/or storage elements, and other suitable input and output devices.

FIG. 1 illustrates one such computer system 100, including a central processing unit (CPU) 110, random access memory (RAM) 120, read only memory (ROM) 122 and an input/output controller 130 coupled by a CPU bus 140. The input/output controller 130 may also be coupled by an input/output bus 198 to input devices such as a keyboard 160, a pointing device 170, e.g., a mouse, and output devices such as a display device 180, e.g., a video monitor. A computer program implementing a routine that 20 manages the control box shown in FIG. 3 may be stored in RAM 120, ROM 122, or on a storage medium or device 190, e.g., CD-ROM, hard disk or magnetic diskette. The computer program may be readable by a general or special purpose programmable computer for configuring and operating the computer to perform the techniques described here.

25 30 What is claimed is:

1. A method of graphically representing base data values and possible data values associated with a quantifiable image property, comprising:

displaying to a user a base state line that represents a range of base data values;

displaying to a user a two-dimensional coordinate space in which the two dimensions are respectively parallel to and normal to the line; and

representing a range of possible data values for each base data value by distances along the normal dimension of the coordinate space from the corresponding base data value on the line.

10 2. The method of claim 1 in which the line is displayed horizontally and the coordinate space is skewed from the horizontal direction.

15 3. The method of claim 1 wherein the two-dimensional coordinate space comprises a polygon, two non-adjacent vertices of the polygon coinciding with the ends of the line in the two-dimensional coordinate space.

20 4. The method of claim 3 wherein the polygon comprises a parallelogram, the parallelogram comprising a first vertical side parallel to a second vertical side and a first skewed side parallel to a second skewed side.

5. The method of claim 4 wherein:

the possible data values represented by endpoints of the first vertical side and the second vertical side comprise the minimum and maximum of the range of possible data values;

25 the possible data values represented by points on the first skewed side comprise the minimum of the range of possible data values; and

the possible data values represented by points on the second skewed side comprise the maximum of the range of possible data values.

6. The method of claim 1, further comprising displaying an active region representing a parameter space of data values that may be assigned when the range of base data values is modified.

5      7. A method of graphically representing base data values and possible data values associated with a quantifiable image property comprising:

displaying to a user a horizontal line that represents a range of base data values, where each point on the line represents all parts of an image that have an image property value indicated by the position of the point on the line;

10     displaying to a user a two-dimensional, parallelogram-shaped coordinate space, in which the two dimensions are respectively parallel to and normal to the horizontal line, wherein the parallelogram shaped coordinate space comprises a first vertical side and a second vertical side, parallel to the normal dimension of the coordinate space, and a first skewed side and a second skewed side, skewed from the direction of the horizontal line;

15     and

representing a range of possible data values by distances along the normal dimension of the coordinate space from corresponding current data values on the line, wherein the possible data values represented by endpoints of the first vertical side and the second vertical side comprise the minimum and maximum of the range of possible data values, and wherein the possible data values represented by points on the first skewed side comprise the minimum of the range of possible data values, and wherein the possible data values represented by points on the second skewed side comprise the maximum of the range of possible data values.

25     8. The method of claim 7 wherein the data values are used in a computer graphics display.

9. The method of claim 7 wherein the quantifiable image property comprises brightness.

30     10. The method of claim 7 wherein the quantifiable image property comprises contrast.

11. A method of interactively transforming data values associated with a quantifiable image property, comprising:

displaying to a user a line that represents a range of base data values associated with a quantifiable image property;

5 displaying to a user a two-dimensional coordinate space in which the two dimensions are respectively parallel to and normal to the line;

representing a range of possible data values by distances along the normal dimension of the coordinate space from corresponding base data values on the line; and

10 interactively providing a curve in the coordinate space, a transformation of each base data value corresponding to the distance along the normal direction in the coordinate space from the curve to the point on the line representing the base data value.

12. The method of claim 11 wherein interactively providing a curve in the coordinate space comprises:

15 receiving from a user an input selecting a point on the line;

receiving from a user an input moving the selected point to a new position in the coordinate space; and

defining a curve in the coordinate space through the ends of the line and through the new position of the point.

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13. The method of claim 11 wherein the tangent to the curve at the new position of the point is parallel to the line.

14. The method of claim 11 further comprising:

25 displaying to a user the base data value of the selected point; and

displaying to a user the new data value of the point as it is dragged, the new data value being determined by the normal distance from the line to the point.

15. The method of claim 11 wherein interactively providing a curve in the coordinate space comprises:

- defining one or more nodes in the coordinate space; and
- defining a curve in the coordinate space through the ends of the line and through

5 the nodes.

16. The method of claim 15 wherein the tangent to the curve at each node is parallel to the line.

10 17. A method of graphically representing base data values and transformed data values, the data values being associated with a quantifiable image property, comprising:

- displaying to a user a line that represents a range of base data values;
- displaying to a user a two-dimensional coordinate space in which the two dimensions are respectively parallel to and normal to the line;

15 representing transformed data values with a curve in the coordinate system; and

- displaying a line along the normal dimension of the coordinate system between an extremum of the curve and the line.

18. A computer program residing on a computer-readable medium, comprising instructions operable to cause a computer to:

- display to a user a line that represents a range of base data values associated with a quantifiable image property;
- display to a user a two-dimensional coordinate space in which the two dimensions are respectively parallel to and normal to the line; and

20 25 represent a range of possible data values by distances along the normal dimension of the coordinate space from corresponding base data values on the line.

19. A computer program residing on a computer-readable medium, comprising instructions operable to cause a computer to:

- display to a user a line that represents a range of current data values associated with a quantifiable image property;
- 5 display to the user a two-dimensional coordinate space in which the two dimensions are respectively parallel to and normal to the line;
- represent a possible range of data values by distances along the normal dimension of the coordinate space from corresponding current data values on the line; and
- 10 provide a curve in the coordinate space based on input from the user, a change in each current data value corresponding to the distance along the normal dimension of the coordinate space from the curve to the point on the line representing the current data value.

20. A computer program residing on a computer-readable medium, comprising instructions operable to cause a computer to:

- display to a user a line that represents a range of old data values associated with a quantifiable image property;
- 15 display to the user a two-dimensional coordinate space in which the two dimensions are respectively parallel to and normal to the line;
- represent new data values with a curve in the coordinate system; and
- 20 display a line along the normal dimension of the coordinate system between an extremum of the curve and the line that shows a correspondence between an old data value on the line and a new data value indicated by the curve.

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21. A computer system for graphically representing base data values and possible data values associated with a quantifiable image property, comprising:

- a means for displaying to a user a line that represents a range of base data values;
- a means for displaying to a user a two-dimensional coordinate space in which the

5 two dimensions are respectively parallel to and normal to the line; and

- a means for representing a range of possible data values by distances along the normal dimension of the coordinate space from corresponding base data values on the line.

10 22. A computer system for interactively transforming a graphical representation of data values associated with a quantifiable image property, comprising:

- a means for displaying to a user a line that represents a range of base data values;
- a means for displaying to a user a two-dimensional coordinate space in which the

15 two dimensions are respectively parallel to and normal to the line;

- a means for representing a range of possible data values by distances along the normal dimension of the coordinate space from corresponding base data values on the line; and
- a means for interactively providing a curve in the coordinate space, a change in each current data value corresponding to the distance along the normal dimension of the

20 coordinate space from the curve to the point on the line representing the current data value.

23. A computer system for graphically representing old data values and new data values, the data values being associated with a quantifiable image property, comprising:

- a means for displaying to a user a line that represents a range of old data values;
- a means for displaying to a user a two-dimensional coordinate space in which the

25 two dimensions are respectively parallel to and normal to the line;

- a means for representing new data values with a curve in the coordinate system;

and

- a means for displaying a line along the normal dimension of the coordinate system between an extremum of the curve and the line.

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24. A computer system for interactively transforming a graphical representation of data values associated with a quantifiable image property, comprising:

- a means for displaying to a user a line that represents a range of current data values;
- 5 a means for displaying to a user a two-dimensional coordinate space in which the two dimensions are respectively parallel to and normal to the line;
- a means for representing a possible range of data values by distances along the normal dimension of the coordinate space from corresponding current data values on the line; and
- 10 a means for interactively providing a curve in the coordinate space, a change in each current data value corresponding to the distance along the normal dimension of the coordinate space from the curve to the point on the line representing the current data value.

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25. A computer system for graphically representing old data values and new data values, the data values being associated with a quantifiable image property, comprising:

- a means for displaying to a user a line that represents a range of old data values;
- a means for displaying to a user a two-dimensional coordinate space in which the two dimensions are respectively parallel to and normal to the line;
- 20 a means for representing new data values with a curve in the coordinate system; and
- a means for displaying a line along the normal dimension of the coordinate system between an extremum of the curve and the line.

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